



Air-Conditioning & Refrigeration

BSc

Lecture 14

Course weekly Outline &

Ch. (Introduction to Air conditioning & Refrigeration)

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Example: Find the volumetric flow rate of air for the building zones if the building has the following data: If the outdoor, indoor and supply temp are 40, 20 and 15 °C respectively

Room	Flower Area (m ³)	Room Height (m)	Number of Persons	Qs	Ventilation Rate
Office	200	3	40	20	12 L/s. Person
Corridor	90	3	—	3	2 Air Change/hr
W.c	50	3	—	2	20 L/s.m ²

Solution

1-Office

$$V = \text{No of Persons} * V_v$$

$$= 40 \times 12 = 480 \text{ L/s} = 0.480 \text{ m}^3/\text{s}$$

$$Q_v = m \times c_p \times (T_{od} - T_{id}) = \rho \times V \times c_p \times (T_{od} - T_{id}) = 1.2 \times 1.005 \times V \times (T_{od} - T_{id})$$

$$Q_v = 1.22 \times V \times (T_{od} - T_{id}) \dots \dots \text{kW}$$

$$= 1.22 \times 0.480 \times (40 - 20) = 11.7 \text{ kW}$$

$$Q_{\text{Office}} = Q_s + Q_v$$

$$= 20 + 11.7 = 31.7 \text{ kW}$$

$$Q_{\text{Office}} = 1.22 \times V_{\text{Office}} \times (T_{id} - T_s)$$

$$V_{\text{Office}} = 31.7 / (1.22 \times (20 - 15))$$

$$\text{Air Flow rate } V_{\text{Office}} = 5.197 \text{ m}^3/\text{s} = 5197 \text{ L/s}$$



2 -Corridor

$$V=2 \times 90 \times 3 / 3600$$

$$=0.150 \text{ m}^3/\text{s}=150 \text{ l/s}$$

$$Q_v= 1.22 \times V \times (T_{od} - T_{id})$$

$$Q_v= 1.22 \times 0.150 \times (40-20)$$

$$=3.66 \text{ kW}$$

$$Q_{\text{Corridor}}=Q_s+Q_v$$

$$=3.000 + 3.66$$

$$=6.66 \text{ kW}$$

Air Flow rate

$$Q_{\text{Corridor}}= 1.22 \times V_{\text{Corridor}} \times (T_{id}-T_s)$$

$$V_{\text{Corridor}} = 6.66 / (1.22 \times (20-15))$$

$$\text{Air Flow rate } V_{\text{Corridor}} =1.092 \text{ m}^3/\text{s}=1092 \text{ l/s}$$



3 -Water Cycle W.c



$$V = 20 \times 50 = 1000 \text{ L/s}$$

$$Q_v = 1.22 \times 1.0 \times (40-20)$$

$$= 24.4 \text{ kW}$$

$$Q_{w.c} = Q_s + Q_v$$

$$= 2 + 24.4$$

$$Q_{w.c} = 26.4 \text{ kW}$$

Air Flow rate

$$Q_{w.c} = 1.22 \times V_{w.c} \times (T_{id} - T_s)$$

$$V_{w.c} = 26.4 / (1.22 \times (20-15))$$

$$= 4.0 \text{ m}^3/\text{s} = 4000 \text{ l/s}$$

$$\text{Total Air Flow rate } V_{\text{Total}} = V_{\text{Office}} + V_{\text{Corridor}} + V_{w.c}$$

$$V_{\text{Total}} = 5197 + 1092 + 4000$$

$$V_{\text{Total}} = 10289 \text{ L/s}$$